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Answer Sheet No. _____

Sign. of Candidate _____

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MATHEMATICS SSC-I (3rd Set)

(Science Group) (Curriculum 2006)

SECTION – A (Marks 15)

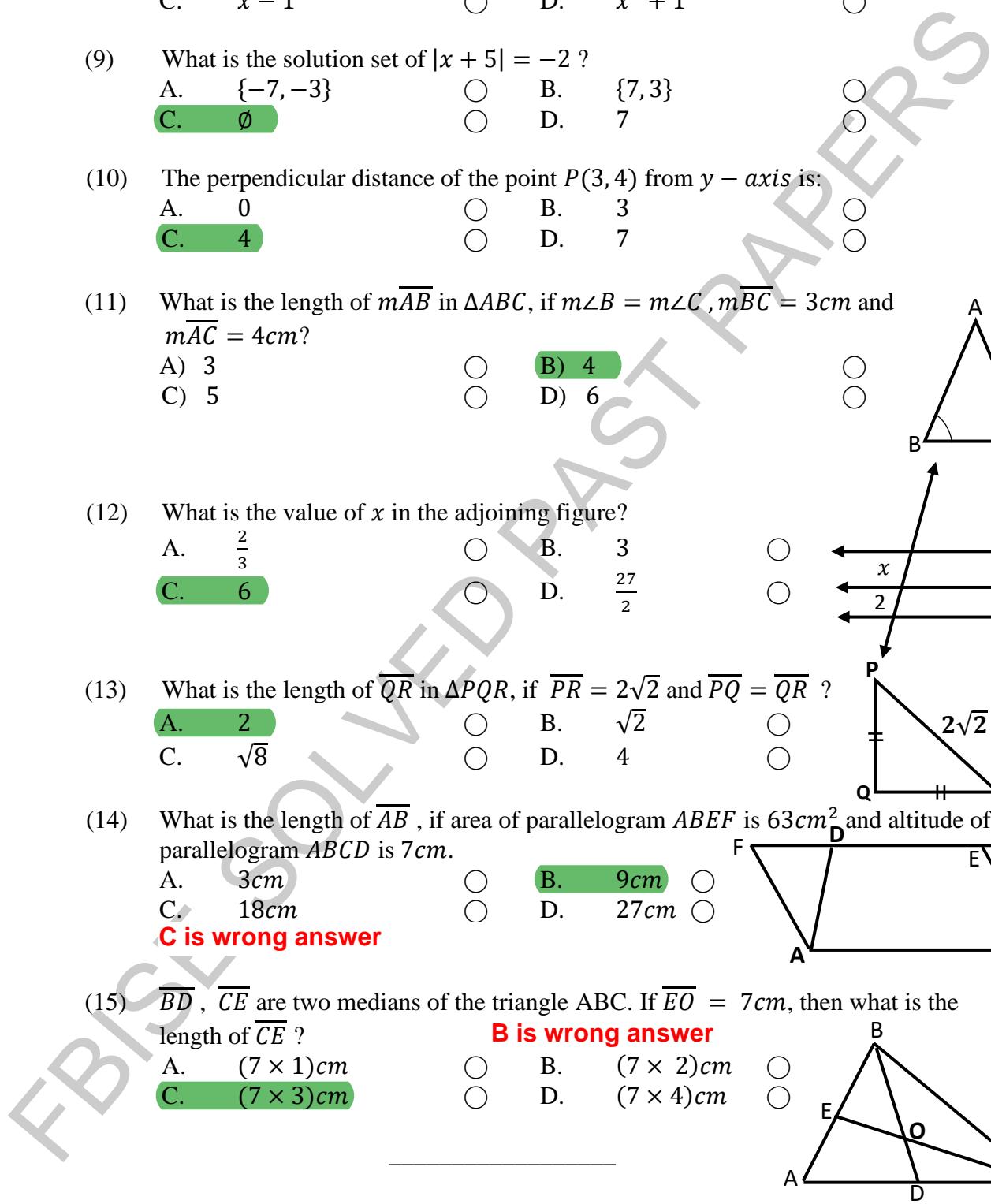
Time allowed: 20 Minutes

Section – A is compulsory. All parts of this section are to be answered on this page and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. **Do not use lead pencil.**

Q.1 Fill the relevant bubble for each part. All parts carry one mark.

- (1) If $A = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$ then value of A^2 is:
- A. $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$ B. $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$
 C. $\begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}$ D. $\begin{bmatrix} 0 & 0 \\ 1 & 1 \end{bmatrix}$
- (2) Imaginary part of $-i(3i + 2)$ is:
- A. -3 B. 3
 C. -2 D. 2
- (3) For what value of x , $\sqrt[3]{3x - 5} = \sqrt[3]{x + 1}$?
- A. 3 B. 6
 C. 3^3 D. 6^3
- (4) If $4x = \log_2 64$ then value of x is: **All answers are wrong**
- A. 32 B. 21
 C. 16 D. -16
- (5) What is the value of 'x' in $(3x)^3 = 27$? **A is wrong answer**
- A. 0 B. 1
 C. 3 D. 4
- (6) Which one of the following is not a polynomial?
- A. $3x + 8$ B. $x^2 + 2x + \sqrt{2}$
 C. $x^2 + 2x + \sqrt{2x}$ D. $x^2 + 2x + \sqrt{2}x$

- (7) The number of zeroes of the polynomial $x^3 + x - 3 - 3x^2$ are:
 A. 0 B. 1 **B is wrong answer**
 C. 2 D. 3
- (8) What is the product of two polynomials, if their HCF is $(x - 1)$ and their LCM is $(x^2 - 2x + 1)$?
 A. $(x - 1)^3$ B. $(x - 1)^2$
 C. $x - 1$ D. $x^3 + 1$
- (9) What is the solution set of $|x + 5| = -2$?
 A. $\{-7, -3\}$ B. $\{7, 3\}$
 C. \emptyset D. 7
- (10) The perpendicular distance of the point $P(3, 4)$ from $y-axis$ is:
 A. 0 B. 3
 C. 4 D. 7
- (11) What is the length of $m\overline{AB}$ in ΔABC , if $m\angle B = m\angle C$, $m\overline{BC} = 3cm$ and $m\overline{AC} = 4cm$?
 A) 3 B) 4
 C) 5 D) 6
- (12) What is the value of x in the adjoining figure?
 A. $\frac{2}{3}$ B. 3
 C. 6 D. $\frac{27}{2}$
- (13) What is the length of \overline{QR} in ΔPQR , if $\overline{PR} = 2\sqrt{2}$ and $\overline{PQ} = \overline{QR}$?
 A. 2 B. $\sqrt{2}$
 C. $\sqrt{8}$ D. 4
- (14) What is the length of \overline{AB} , if area of parallelogram $ABEF$ is $63cm^2$ and altitude of parallelogram $ABCD$ is 7cm.
 A. 3cm B. 9cm
 C. 18cm D. 27cm
- C is wrong answer**
- (15) \overline{BD} , \overline{CE} are two medians of the triangle ABC. If $\overline{EO} = 7cm$, then what is the length of \overline{CE} ?
 A. $(7 \times 1)cm$ B. $(7 \times 2)cm$
 C. $(7 \times 3)cm$ D. $(7 \times 4)cm$
-





SOLUTION QUESTION MODEL PAPER (3rd Set) SSC-I

MATHEMATICS

SECTION-A

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
B	C	A	A	A	C	B	A	C	C	B	C	A	C	B

SECTION-B

Question 2

(i) $A = \begin{bmatrix} 1 & 2 \\ 1 & 3 \end{bmatrix}$ $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

(a) $\det(A) = (1)(3) - (2)(1) = 1$ → (01)mark

$\text{Adj}(A) = \begin{bmatrix} 3 & -2 \\ -1 & 1 \end{bmatrix}$ → (01)mark

(b) $A(\text{Adj}A) = \begin{bmatrix} 1 & 2 \\ 1 & 3 \end{bmatrix} \begin{bmatrix} 3 & -2 \\ -1 & 1 \end{bmatrix} = \begin{bmatrix} 3-2 & -2+2 \\ 3-3 & -2+3 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} = I$ → (01)mark

$(\text{Adj}A)A = \begin{bmatrix} 3 & -2 \\ -1 & 1 \end{bmatrix} \begin{bmatrix} 1 & 2 \\ 1 & 3 \end{bmatrix} = \begin{bmatrix} 3-2 & 6-6 \\ -1+1 & -2+3 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} = I$ → (01)mark

Hence $A(\text{Adj}A) = (\text{Adj}A)A$

(ii) $(x - iy)(3 + 5i) = \overline{-6 - 24i}$

$(3x + 5y) + (5x - 3y)i = -6 + 24i$ → (01)mark

$3x + 5y = -6$ $5x - 3y = 24$ → (01)mark

Multiplying equations by -5 and by 3 respectively then adding the resultant

$-15x - 25y + 15x - 9y = 30 + 72 \Rightarrow y = -3$ → (01)mark

Multiplying equations by 3 and by 5 respectively then adding the resultant

$9x + 15y + 25x - 15y = -18 + 120 \Rightarrow x = 3$ → (01)mark

(iii) $\log_4(64)^{n+1} = \log_5(625)^{n-1}$

$\log_4(4)^{3(n+1)} = \log_5(5)^{4(n-1)}$ → (01)mark

$3(n+1) \log_4 4 = 4(n-1) \log_5 5$ → (01)mark

$3(n+1) = 4(n-1)$ → (01)mark

$n = 7$ → (01)mark

(iv) $\frac{1}{x} = \sqrt{7} + \sqrt{6}$

$x = \frac{1}{\sqrt{7}+\sqrt{6}} \times \frac{\sqrt{7}-\sqrt{6}}{\sqrt{7}-\sqrt{6}} = \sqrt{7} - \sqrt{6}$ → (01)mark

$x + \frac{1}{x} = (\sqrt{7} + \sqrt{6}) + (\sqrt{7} - \sqrt{6}) = 2\sqrt{7}$ → (01)mark

$x - \frac{1}{x} = (\sqrt{7} + \sqrt{6}) - (\sqrt{7} - \sqrt{6}) = 2\sqrt{6}$ → (01)mark

$\left(x + \frac{1}{x}\right)\left(x - \frac{1}{x}\right) = (2\sqrt{7})(2\sqrt{6}) = 4\sqrt{42}$ → (01)mark

(v) $P(x) = x^4 - 2x^3 - 11x^2 - 8x - 60$

At $x = -3$

$$P(-3) = (-3)^4 - 2(-3)^3 - 11(-3)^2 - 8(-3) - 60 = 0$$

Thus $(x + 3)$ is a factor of $P(x)$. $\rightarrow (01)mark$

On dividing $P(x)$ by $(x + 3)$

Other factor of $P(x) = (x^3 - 5x^2 + 4x - 20)$

$$\begin{array}{r} x^3 - 5x^2 + 4x - 20 \\ x + 3 \sqrt{x^4 - 2x^3 - 11x^2 - 8x - 60} \\ \underline{-x^4 - 3x^3} \\ -5x^3 - 11x^2 - 8x - 60 \\ \underline{+5x^3 + 15x^2} \\ 4x^2 - 8x - 60 \\ \underline{-4x^2 - 12x} \\ -20x - 60 \\ \underline{+20x + 60} \\ 0 \end{array}$$

$P(x) = (x^3 - 5x^2 + 4x - 20)(x + 3) \rightarrow (02)marks$

$P(x) = [x^2(x - 5) + 4(x - 5)](x + 3)$

$P(x) = (x - 5)(x^2 + 4)(x + 3) \rightarrow (01)mark$

(vi) Let $P(x)$ be the required polynomial and $Q(x) = x^2 - 5x - 14$ the given polynomial with

HCF = $x - 7$ and LCM = $x^3 - 10x^2 + 11x + 70$

$$P(x) = \frac{(HCF)(LCM)}{Q(x)} \rightarrow (01)mark$$

$$P(x) = \frac{(x-7)(x^3 - 10x^2 + 11x + 70)}{(x^2 - 5x - 14)}$$

$$P(x) = \frac{(x-7)(x^3 - 10x^2 + 11x + 70)}{(x-7)(x+2)} \rightarrow (01)mark$$

$$P(x) = \frac{(x^3 - 10x^2 + 11x + 70)}{(x+2)}$$

$$P(x) = x^2 - 3x - 10 \rightarrow (02)marks$$

$$\begin{array}{r} x^2 - 3x - 10 \\ x - 7 \sqrt{x^3 - 10x^2 + 11x + 70} \\ \underline{-x^3 - 7x^2} \\ -3x^2 + 11x + 70 \\ \underline{+3x^2 + 21x} \\ -10x + 70 \\ \underline{+10x + 70} \\ 0 \end{array}$$

(vii) $\left| \frac{3x+9}{2x+1} \right| - 9 = 5$

$$\left| \frac{3x+9}{2x+1} \right| = 14$$

$$\frac{3x+9}{2x+1} = 14 \rightarrow (01)mark$$

$$3x + 9 = 14(2x + 1)$$

$$3x + 9 = 28x + 14$$

$$25x = -5$$

$$x = -\frac{1}{5} \rightarrow (01)mark$$

$$\text{Solution Set} = \left\{ -\frac{1}{5}, -\frac{23}{31} \right\}$$

$$\frac{3x+9}{2x+1} = -14 \rightarrow (01)mark$$

$$3x + 9 = -14(2x + 1)$$

$$3x + 9 = -28x - 14$$

$$31x = -23$$

$$x = -\frac{23}{31} \rightarrow (01)mark$$

(viii) $\frac{2}{3} \leq \frac{1+x}{6} \leq \frac{3}{4}$

$$\frac{2}{3} \leq \frac{1+x}{6}; \quad \frac{1+x}{6} \leq \frac{3}{4} \rightarrow (01)mark$$

$$\frac{12}{3} \leq 1+x; \quad 1+x \leq \frac{18}{4} \rightarrow (01)mark$$

$$4 - 1 \leq x ; \quad x \leq \frac{9}{2} - 1 \rightarrow (01)mark$$

$$3 \leq x ; \quad x \leq \frac{7}{2} \rightarrow (01)mark$$

$$\text{Solution Set} = \left\{ x | x \in R \wedge 3 \leq x \leq \frac{7}{2} \right\}$$

$$(ix) \quad x + 2y = -4$$

$$y = -\frac{1}{2}(x + 4)$$

x	2	0	-2	-4
y	-3	-2	-1	0

$\rightarrow (01)mark$

$$2x + 4y = 8$$

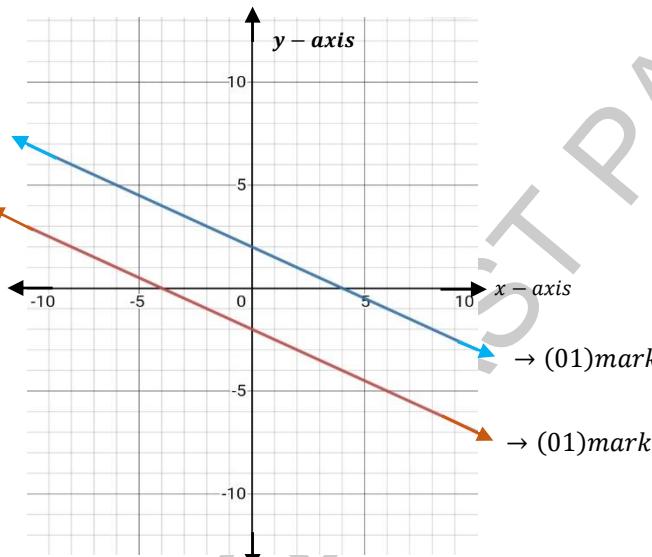
$$y = -\frac{1}{2}(x - 4)$$

x	4	2	0	-2
y	0	1	2	3

$\rightarrow (01)mark$

$$x + 2y = -4$$

$$2x + 4y = 8$$



The given system of linear equations represents a pair of parallel straight lines on the graph.

Therefore Solution Set = { }

$$(x) \quad P(3, 3), Q(8, 3), R(3, 12)$$

$$|PQ| = \sqrt{(8 - 3)^2 + (3 - 3)^2} = 5 \rightarrow (01)mark$$

$$|QR| = \sqrt{(3 - 8)^2 + (12 - 3)^2} = \sqrt{106} = 10.3 \rightarrow (01)mark$$

$$|PR| = \sqrt{(3 - 3)^2 + (12 - 3)^2} = 9 \rightarrow (01)mark$$

$$|PQ| + |QR| = 5 + 10.3 = 15.3 \neq |PR| \rightarrow (01)mark$$

Therefore given points are not collinear.

(xi) Let ABCD represents a rectangular doorway

By Pythagoras Theorem

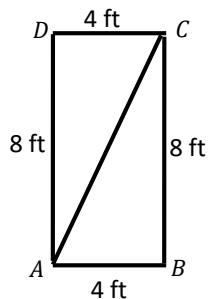
$$m|\overline{AC}|^2 = m|\overline{AB}|^2 + m|\overline{BC}|^2 \rightarrow (01)mark$$

$$m|\overline{AC}|^2 = 4^2 + 8^2 \rightarrow (01)mark$$

$$m|\overline{AC}|^2 = 80$$

$$m\overline{AC} = \sqrt{80} = 8.94 \text{ feet} \rightarrow (01)mark$$

Since $8.94 \text{ ft} < 9 \text{ ft}$, so 9 feet wide table can pass through the rectangular doorway. $\rightarrow (01)mark$



(xii) Consider a parallelogram ABCD.

In right ΔCDA (by Pythagoras Theorem)

$$m|\overline{CD}|^2 = m|\overline{AD}|^2 + m|\overline{AC}|^2 \rightarrow (01)mark$$

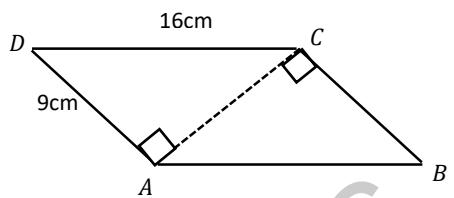
$$m|\overline{AC}|^2 = m|\overline{CD}|^2 - m|\overline{AD}|^2$$

$$m|\overline{AC}|^2 = 16^2 - 9^2 = 175$$

$$m|\overline{AC}| = \sqrt{175} = 13.23m \rightarrow (01)mark$$

$$\text{Area of } \Delta CDA = \frac{1}{2}(m|\overline{AD}|)(m|\overline{AC}|) = \frac{1}{2}(9)(13.23) = \frac{1}{2}(119.07) \rightarrow (01)mark$$

$$\text{Area of parallelogram } ABCD = 2(\text{Area of } \Delta CDA) = 119.07m \rightarrow (01)mark$$



(xiii) $x + y = 8 \Rightarrow y = 8 - x \rightarrow \text{eqn - I}$

$$m\overline{BX}: m\overline{CX} = m\overline{AB}: m\overline{AC} \rightarrow (01)mark$$

$$x:y = 5:4$$

$$4x = 5y \rightarrow (01)mark$$

$$4x = 5(8 - x) \text{ From eqn - I}$$

$$4x = 40 - 5x$$

$$x = \frac{40}{9} \rightarrow (01)mark$$

Using eqn - I

$$y = 8 - \frac{40}{9} = \frac{32}{9} \rightarrow (01)mark$$

(xiv) **Figure:** $\rightarrow (0.5)mark$

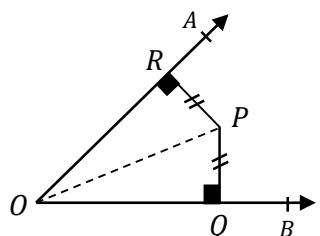
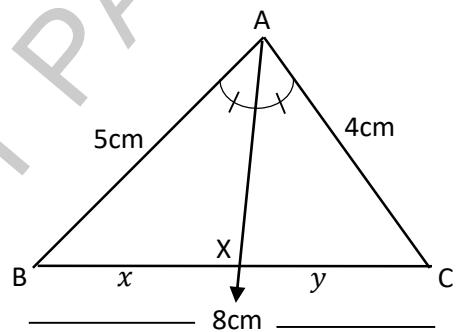
Given: Any point P lies inside $\angle AOB$ such that $\overline{PQ} = \overline{PR}$,

where $\overline{PQ} \perp \overline{OB}$ and $\overline{PR} \perp \overline{OA}$. $\rightarrow (0.5)mark$

To Prove: Point P is on the bisector of $\angle AOB$. $\rightarrow (0.5)mark$

Construction: Join P to O. $\rightarrow (0.5)mark$

Proof:



Statements	Reasons	
In $\Delta POQ \leftrightarrow \Delta POR$		
$\angle PQO \cong \angle PRO$	Given	$\rightarrow (0.5)mark$
$\overline{PO} \cong \overline{PO}$	Common	$\rightarrow (0.5)mark$
$\overline{PQ} \cong \overline{PR}$	Given	$\rightarrow (0.5)mark$
$\therefore \Delta POQ \cong \Delta POR$	H.S. Postulate	$\rightarrow (0.5)mark$
Hence $\angle POQ \cong \angle POR$	Corresponding angles of congruent triangles	
i.e. P is on the bisector of $\angle AOB$		

SECTION-C

Q3. $AB = \begin{bmatrix} 3 & 4 \\ 2 & 3 \end{bmatrix} \begin{bmatrix} 3 & 7 \\ 2 & 5 \end{bmatrix} = \begin{bmatrix} 9+8 & 21+20 \\ 6+6 & 14+15 \end{bmatrix} = \begin{bmatrix} 17 & 41 \\ 12 & 29 \end{bmatrix}$ → (01)mark

$$|AB| = (17)(29) - (41)(12) = 1 \quad \text{Adj}(AB) = \begin{bmatrix} 29 & -41 \\ -12 & 17 \end{bmatrix} \rightarrow (0.5 + 0.5)\text{mark}$$

$$(AB)^{-1} = \frac{1}{|AB|} \cdot \text{Adj}(AB) = \begin{bmatrix} 29 & -41 \\ -12 & 17 \end{bmatrix} \rightarrow (0.5 + 0.5)\text{mark}$$

$$|B| = (3)(5) - (7)(2) = 1 \quad \text{Adj}(B) = \begin{bmatrix} 5 & -7 \\ -2 & 3 \end{bmatrix} \rightarrow (0.5 + 0.5)\text{mark}$$

$$B^{-1} = \frac{1}{|B|} \cdot \text{Adj}(B) = \begin{bmatrix} 5 & -7 \\ -2 & 3 \end{bmatrix} \rightarrow (0.5 + 0.5)\text{mark}$$

$$|A| = (3)(3) - (4)(2) = 1 \quad \text{Adj}(A) = \begin{bmatrix} 3 & -4 \\ -2 & 3 \end{bmatrix} \rightarrow (0.5 + 0.5)\text{mark}$$

$$A^{-1} = \frac{1}{|A|} \cdot \text{Adj}(A) = \begin{bmatrix} 3 & -4 \\ -2 & 3 \end{bmatrix} \rightarrow (0.5 + 0.5)\text{mark}$$

$$B^{-1}A^{-1} = \begin{bmatrix} 5 & -7 \\ -2 & 3 \end{bmatrix} \begin{bmatrix} 3 & -4 \\ -2 & 3 \end{bmatrix} = \begin{bmatrix} 15+14 & -20-21 \\ -6-6 & 8+9 \end{bmatrix} = \begin{bmatrix} 29 & -41 \\ -12 & 17 \end{bmatrix} \rightarrow (01)\text{mark}$$

Q4. $\frac{x}{x^2-x-2} - \frac{1}{x^2+5x-14} - \frac{2}{x^2+8x+7} = \frac{x+3}{x^2+5x-14}$
 $x^2 - x - 2 = x^2 - 2x + x - 2 = x(x-2) + 1(x-2) = (x-2)(x+1)$ → (01)mark
 $x^2 + 5x - 14 = x^2 - 2x + 7x - 14 = x(x-2) + 7(x-2) = (x-2)(x+7)$ → (01)mark
 $x^2 + 8x + 7 = x^2 + x + 7x + 7 = x(x+1) + 7(x+1) = (x+1)(x+7)$ → (01)mark
 $x^2 + 5x - 14 = x^2 - 2x + 7x - 14 = x(x-2) + 7(x-2) = (x-2)(x+7)$ → (01)mark

$$\frac{x}{(x-2)(x+1)} - \frac{1}{(x-2)(x+7)} - \frac{2}{(x+1)(x+7)} = \frac{x+3}{(x-2)(x+7)}$$

$$\frac{x(x+7)-(x+1)-2(x-2)}{(x-2)(x+1)(x+7)} = \frac{x+3}{(x-2)(x+7)} \rightarrow (01)\text{mark}$$

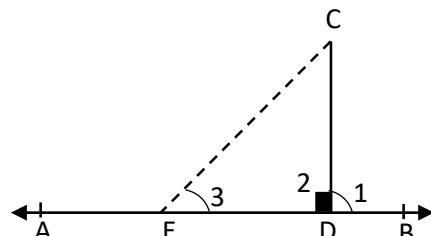
$$\frac{x^2+7x-x-1-2x+4}{(x-2)(x+1)(x+7)} = \frac{x+3}{(x-2)(x+7)} \rightarrow (0.5)\text{mark}$$

$$\frac{x^2+4x+3}{(x-2)(x+1)(x+7)} = \frac{x+3}{(x-2)(x+7)} \rightarrow (01)\text{mark}$$

$$\frac{(x+1)(x+3)}{(x-2)(x+1)(x+7)} = \frac{x+3}{(x-2)(x+7)} \rightarrow (01)\text{mark}$$

$$\frac{x+3}{(x-2)(x+7)} = \frac{x+3}{(x-2)(x+7)} \rightarrow (0.5)\text{mark}$$

Q5. Figure: → (01)mark



Given: A point C not lying on \overleftrightarrow{AB} . A point D lying on \overleftrightarrow{AB} such that $\overline{CD} \perp \overleftrightarrow{AB}$. → (01)mark

To Prove: \overline{CD} is the shortest distance from C to \overleftrightarrow{AB} . → (01)mark

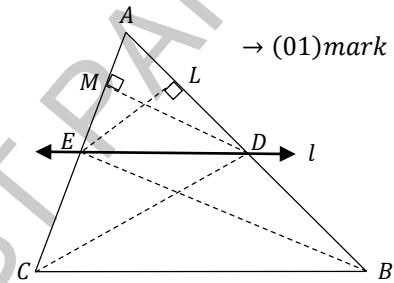
Construction: Take a point E on \overleftrightarrow{AB} . Join C to E to form a ΔCDE .

→ (01)mark

Proof:

Statements	Reasons	
In ΔCDE $m\angle 1 > m\angle 3$ → (i)	An exterior angle of a triangle is greater than non-adjacent interior angle	→ (01)mark
$m\angle 1 = m\angle 2$ → (ii)	Supplement of right angle	→ (01)mark
$m\angle 2 > m\angle 3$	from (i) & (ii)	→ (0.5)mark
$m\angle 3 < m\angle 2$	If $a > b$ then $b < a$	
$m\overline{CD} < m\overline{CE}$	Opposite side of smaller angle	→ (01)mark
But E is any point on AB		
Hence \overline{CD} is the shortest distance from C to \overleftrightarrow{AB}		→ (0.5)mark

Q6. Figure:



Given: In ΔABC , line l is intersecting sides \overline{AC} and \overline{AB} at points E and D respectively such that $\overline{ED} \parallel \overline{CB}$. → (01)mark

To Prove: $m\overline{AD} : m\overline{DB} = m\overline{AE} : m\overline{EC}$ → (01)mark

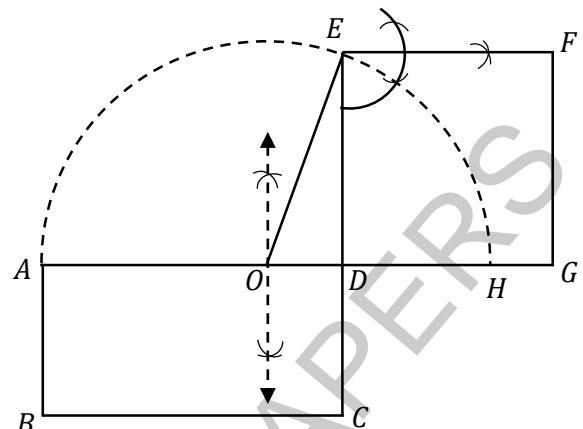
Construction: Join B to E; C to D. Draw $\overline{DM} \perp \overline{AC}$ and $\overline{EL} \perp \overline{AB}$. → (01)mark

Proof:

Statements	Reasons	
In triangles BED and AED, \overline{EL} is the common perpendicular.		
$\therefore \text{Area of } \Delta BED = \frac{1}{2}(m\overline{BD})(m\overline{EL})$ → (i)	Area of a $\Delta = \frac{1}{2}$ (base) (height)	→ (0.5)mark
$\therefore \text{Area of } \Delta AED = \frac{1}{2}(m\overline{AD})(m\overline{EL})$ → (ii)	Area of a $\Delta = \frac{1}{2}$ (base) (height)	→ (0.5)mark
$\Rightarrow \frac{\text{Area of } \Delta BED}{\text{Area of } \Delta AED} = \frac{m\overline{DB}}{m\overline{AD}}$ → (iii)	Dividing (i) by (ii)	→ (0.5)mark
$\Rightarrow \frac{\text{Area of } \Delta CDE}{\text{Area of } \Delta ADE} = \frac{m\overline{EC}}{m\overline{AE}}$ → (iv)	similarly	→ (0.5)mark
But Area of $\Delta BED \cong$ Area of ΔCDE	Areas of triangle with common base and same altitudes are equal. Given that $\overline{ED} \parallel \overline{CB}$. So altitudes are equal.	→ (01)mark
$\frac{m\overline{DB}}{m\overline{AD}} = \frac{m\overline{EC}}{m\overline{AE}}$	From (iii) and (iv)	→ (0.5)mark
$\frac{m\overline{AD}}{m\overline{DB}} = \frac{m\overline{AE}}{m\overline{EC}}$	On taking reciprocals	→ (0.5)mark
$m\overline{AD} : m\overline{DB} = m\overline{AE} : m\overline{EC}$		

Q7. (a) Construction Steps

- (i) Construct a 4 by 2 rectangle. → (01)mark
- (ii) Produce \overline{AD} to H making $m\overline{DH} = m\overline{CD}$.
- (iii) Bisect \overline{AH} at O. → (01)mark
- (iv) With centre O and radius \overline{OA} describe a semi-circle. → (01)mark
- (v) Produce \overline{CD} to meet the semi-circle in E.
- (vi) On \overline{DE} as a side construct a square DGFE (the required one). → (01)mark



(b) $m\overline{DG} = m\overline{GF} = m\overline{FE} = m\overline{DE} = 2.8\text{cm}$ → (01)mark
 Area of Square $DGFE = (2.8)(2.8) = 7.84\text{cm}^2$ → (01)mark

(c) Area of Rectangle $ABCD = (4)(2) = 8\text{cm}^2$ → (01)mark
Area of Square DGFE ≈ *Area of Rectangle ABCD* → (01)mark